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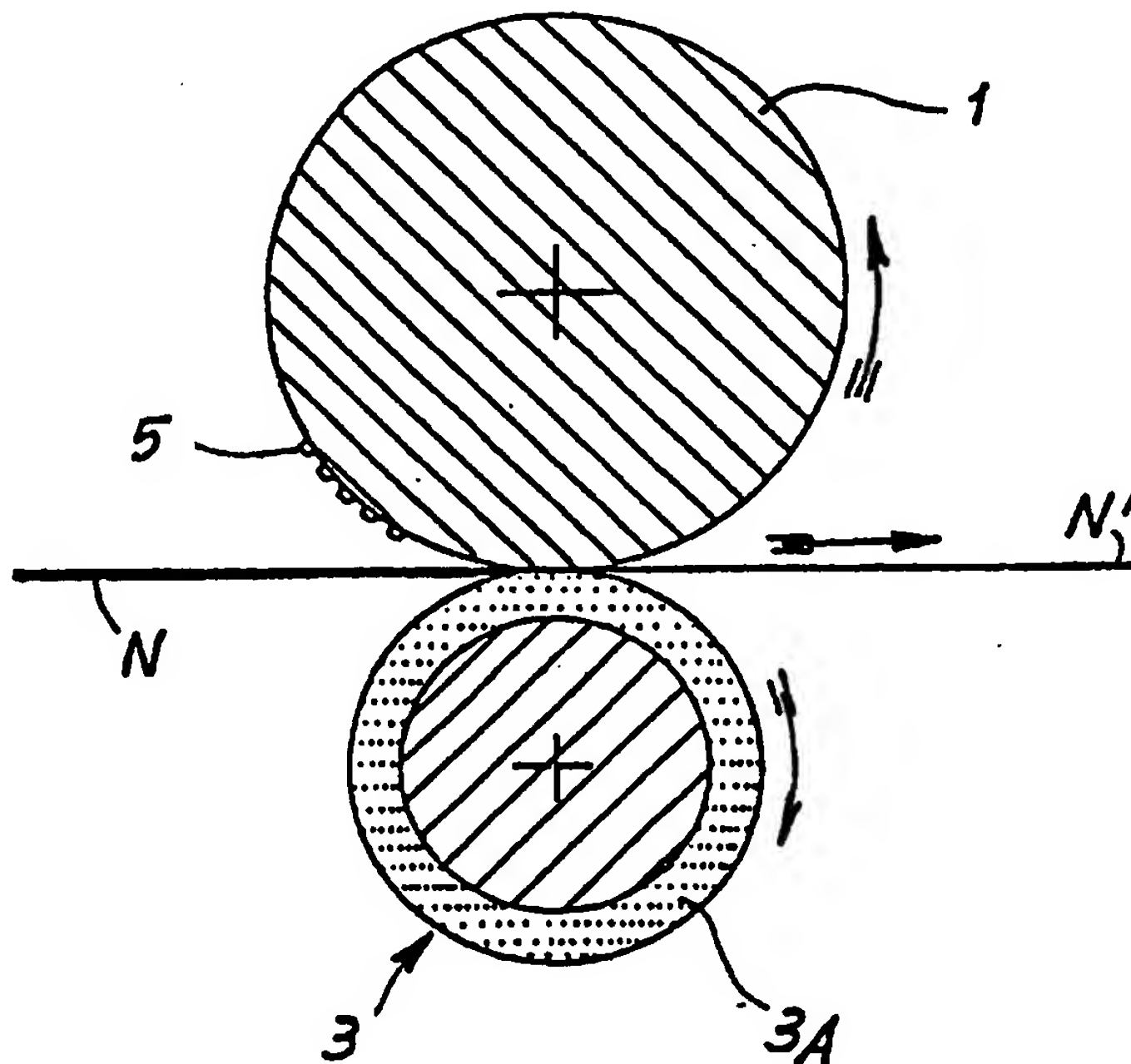
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(21) International Application Number: PCT/IT97/00136 (22) International Filing Date: 16 June 1997 (16.06.97) (30) Priority Data: FI96A000152 21 June 1996 (21.06.96) IT (71) Applicant (for all designated States except US): FABIO PERINI S.P.A. [IT/IT]; Via per Mugnano, I-55100 Lucca (IT). (72) Inventor; and (75) Inventor/Applicant (for US only): BIAGIOTTI, Guglielmo [IT/IT]; Via di Vorno, 105, I-55012 Capannori (IT). (74) Agents: MANNUCCI, Michele et al.; Via della Scala, 4, I-50123 Firenze (IT).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.	

(54) Title: **DEVICE AND METHOD FOR EMBOSsing A STRIP MATERIAL, AND PRODUCT THUS OBTAINED**

(57) Abstract

An embossing roller (1) is described that comprises a plurality of projections (5) distributed in a given pattern over a surface of the said embossing roller. A recessed design is also formed in the surface of the embossing roller and consists of one or more indentations or incisions (7) that extend from the tops of the said projections (5) to the bases thereof.



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"Device and method for embossing a strip material, and product thus obtained"

Description

5

Technical Field

The present invention relates to an embossing roller that comprises a plurality of projections distributed in a given pattern over its surface, for embossing
10 a laminar strip material such as, for example, a strip of paper, plastic, tissue paper or similar products.

The invention also relates to an embossing unit incorporating at least one embossing roller of the above type and to an associated embossing method.

15 Lastly, the invention relates to a laminar embossed product obtained using a roller and a method according to the invention.

Background Art

20 Embossing is a process which is often used in the paper converting industry, especially in the processing of what is known as "tissue" paper, for the production of toilet paper, tissues, kitchen roll and the like.

25 Embossing involves deforming the laminar material by compressing it between a roller provided with projections of various shapes and a pressure roller which may be smooth or may also be provided with projections or indentations and which may be made of a
30 rigid or yielding material. Various embossing techniques have been developed over the years, these differing both in terms of the type and number of rollers and counter-rollers used and in terms of the methods whereby the material to be treated is passed between the rollers.
35 The strip material can consist of one or more webs that can be passed through a single nip between the embossing roller and the pressure roller. This technique is, for example, described in US-A-4,659,608.

According to other embossing techniques, two or
40 more webs are passed between separate pairs of embossing

rollers and pressure rollers and are then joined together using various techniques. Examples of embossing units of this type are described in US-A-2,978,006, US-A-3,414,459, US-A-3,694,300, US-A-3,881,210, US-A-3,556,907, US-A-4,320,162, US-A-4,483,728, EP-A-0,370,972, WO-A-95/02089, WO-A-94/15776, and others.

Usually, the embossing roller has a plurality of projections of various shapes, for example frustopyramidal or frustoconical projections (or even of more complex shape), which are distributed in a repeating geometric pattern - for example in helical alignments. In some cases, projections of different shapes and heights are present on the same embossing surface of a single embossing roller, as, for example, described in US-A-4,320,162. In this case, for example, the embossing roller has a series of frustopyramidal or frustoconical projections arranged in helical alignments, but in some, geometrically distributed, areas the frustopyramidal projections are absent and are replaced with projections of a different height which represent a composite design. This embossing roller gives a complex embossed effect. However, preparing the roller surface is extremely difficult since projections of varying shapes and heights need to be made in an extremely accurate pattern.

Application No. FI 94 O 000067 for a multiple registered design, filed on 17 November 1994 by the same applicant, discloses a series of embossing cylinders provided with frustopyramidal projections arranged in various designs. Some of these have a series of continuous channels which run parallel to the direction of the projections and which can be produced during the same process as that in which the projections are made. There is no provision for recessed designs which are discontinuous and/or not parallel to the alignments of the projections on the cylinder.

Summary of the Invention

The invention proposes a new type of embossing roller which is inexpensive and simple to produce and which enables embossed materials with specific aesthetic effects to be obtained. The low costs involved in preparing the roller surface mean that different rollers can be made inexpensively according to the specific requirements of individual users.

Basically, the roller according to the invention has an embossing surface provided with projections, on which surface a recessed design is formed which consists of one or more indentations or incisions that extend from the tops of the projections to the bases thereof and whose depth is preferably greater than the height of the said projections. Such a design can be made quite easily, for example by milling, optionally using a form milling cutter so as to avoid generating sharp edges and thereby minimize problems of wear of the pressure roller. The projections can be made in a prior process by means of one of the known systems, for example using chip-removal, chemical or plastic-deformation processes. Whereas the basic preparation of the roller surface in order to produce the projections is lengthy and expensive, producing the subsequent recessed design is a relatively simple operation. This means that embossing rollers with customized designs can be made available to various users, using a standard embossing roller - that is one provided with conventional projections - as a starting point.

The recessed design may consist of incisions which are not parallel to the alignments of the projections, or of incisions which are parallel to the alignments of the projections but are not continuous, that is, for example, of lines forming rectangles or squares. Generally speaking, the design can be discontinuous and not parallel to the alignments of the projections. These options are made possible by the fact that the recessed design is not formed at the same time as the projections

are formed, but in a subsequent stage, once the roller has already been provided with the projections.

Using an embossing roller of this type in a conventional embossing unit produces an embossed strip material with a traditional pattern, for example with frustoconical or frustopyramidal points, over which a relief design corresponding to the recessed design formed on the embossing roller is superimposed. The design is particularly sharp and prominent when the density of the projections is fairly high, for example between 30 and 50 projections per cm^2 or higher. However, the possibility of forming the same design on rollers with a lower projection density, for example of between 5 and 100 or, preferably, of between 10 and 60 projections per cm^2 , is not excluded.

The embossing unit can be of the type comprising a single embossing roller and an associated pressure roller, between which one or more webs forming the strip material are passed. In this case a relief design will be formed on one face of the material, while a corresponding recessed design will be produced on the other face. The material will then be packaged in such a way that the relief design will be on show.

On the other hand, the embossing unit can also be of the type with two embossing rollers, each of which is provided with an associated pressure roller. In this case the webs forming the strip material are embossed separately and then joined together. It is thus possible to obtain various web combinations, as will be described in greater detail below.

Further advantageous features of the embossing roller, embossing unit, method of preparation and strip material according to the invention are given in the appended claims, which form an integral part of the present description.

Brief description of the drawings

A better understanding of the invention will be gained from the description and appended drawing, which

shows a practical and non-limiting example of the said invention. In the drawing:

Fig. 1 shows an embossing unit into which the present invention can be incorporated;

5 Fig. 2 shows a greatly enlarged diagrammatic cross-section of the embossing zone;

Fig. 3 shows a planar development of a portion of the embossing roller of Fig. 1;

Fig. 4 shows a planar development of a portion
10 of strip material embossed by the roller portion of Fig. 3;

Fig. 5 shows a more complex embossing unit into which the present invention can be incorporated;

Fig. 6 shows a diagrammatic enlargement of the
15 lamination zone of the embossing unit of Fig. 5 in a first embodiment;

Fig. 7 shows an enlarged cross-section of a laminar material as it comes out of the embossing unit of Fig. 5 in a first embodiment;

20 Fig. 8 shows a diagrammatic enlargement of the lamination zone of the embossing unit of Fig. 5 in a second embodiment;

Fig. 9 shows an enlarged and diagrammatic cross-section of the strip material as it comes out of the
25 embossing unit of the second embodiment;

Fig. 10 shows a diagrammatic enlargement of a portion of strip material embossed according to a third embodiment; and

30 Figs 11 and 12 show a planar development of a portion of an embossing roller and a local section through the said roller respectively, in a further embodiment.

Detailed description of the invention

35 Referring initially to Figs 1 to 4, a first embodiment of the invention will initially be described.

Fig. 1 shows a particularly simple embossing unit comprising an embossing roller 1 working in conjunction with a pressure roller 3. The two rollers 1

and 3 are pressed against each other and a strip material N to be embossed, for example made of tissue paper, is passed through the nip formed between them. The rollers 1 and 3 rotate in opposite directions, as indicated by the arrows in the drawing, while the strip material advances between them.

The embossing roller 1 is provided with a plurality of projections or protuberances 5 on its active surface, while the pressure roller 3 has a smooth external cylindrical cover made of an elastically yielding material which deforms under the pressure of the projections 5, as diagrammatically illustrated in Fig. 2. The projections 5 have a top 5E and a base 5B, with the distance - measured in a radial direction - between the base and the top defining the height H of the projections.

The strip material N can consist of a single web or a plurality of webs which, as they pass between the rollers 1 and 3, are joined together and embossed.

In addition to the projections 5, the surface of the embossing roller 1 has a recessed design formed by a plurality of channels or indentations 7 which can be seen in the planar development (Fig. 3) of a portion of the active surface of the roller 3. The channels or indentations 7 form a design which is chosen by the user employing the machines and is reproduced on the strip material N in the form of a relief design D (Fig. 4) on one face and a recessed design on the other face.

The depth of the channels 7 (in the example illustrated) is greater than the height H (Fig. 2) of the projections 5 on the roller 1, so that the design D is particularly well defined on the material N.

In a modified embodiment, one or more non-embossed webs can be joined to the embossed material coming out from the pair of rollers 1 and 3, these webs being applied to the rear surface - that is the surface in contact with the pressure roller. The embossed web or webs can be joined to the smooth web by applying a glue and with the aid of a smooth counter-roller which, for

example, works in conjunction with the said embossing roller 1.

Fig. 5 shows a different type of embossing unit, known in the art, into which the present invention can be incorporated. This embossing unit has two embossing rollers 13, 15, each of which is provided with a plurality of projections 13P, 15P arranged in identical, symmetrical or different positions on the two rollers 13, 15, as is known per se. Each embossing roller works in conjunction with an associated pressure roller 16, 17 covered with a cover 16A, 17A made of elastically yielding material. The reference 19 indicates a glue-applying unit.

A first web V1 of a strip material N is passed between the two rollers 13, 16 and embossed between the said two rollers, while a second web V2 is embossed between the rollers 15 and 17. The two embossing rollers 13, 15 are positioned next to each other and are pressed against each other in a contact and lamination zone in which the two, separately embossed, webs V1 and V2 are joined together. The glue-applying unit 19 applies glue to those portions of the web V2 located on the projections of the embossing roller 15 so that the two webs V1, V2 can be securely joined together in the lamination zone.

According to the invention, at least one of, or both the embossing rollers 13, 15 have an incised recessed design similar to the design formed by the channels 7 in the roller 1 of the embossing unit shown in Fig. 1.

When both the embossing rollers have a recessed design, the said designs can be the same or different. Furthermore, in either case, these designs can be in phase or staggered. In the former case, two relief designs - matching on both faces - will be produced on the embossed strip material, while in the latter case the relief designs will not match.

Fig. 6 diagrammatically shows a cross-section through a planar development of the lamination zone

between the two embossing rollers 13, 15 with the two previously embossed webs V1, V2 being joined together at the point where the projections 13P, 15P of the two rollers 13, 15 meet. The references 13C and 15C denote
5 the channels formed in the surfaces of the two rollers 13, 15, the depth of which is greater than the height of the projections 13P, 15P, and which correspond to the channels 7 in the example of Figs 1 to 4.

Fig. 7 shows a diagrammatic and greatly enlarged
10 local cross-section of a portion of strip material N produced using the embossing unit of Fig. 5. V1 and V2 denote the two webs forming the material N, which have been joined together by means of the glue C in the zones embossed by the projections 13P, 15P. D1 and D2 denote
15 the sections of the relief designs which are produced by the recessed designs formed in the two embossing rollers 13, 15. The two designs D1 and D2 may or may not coincide.

Fig. 8 shows an embodiment in which only the
20 roller 15 is provided with a recessed design, defined by channels 15C, while the embossing roller 13 is provided only with projections 13P. Using this pair of embossing rollers produces a strip material - illustrated in the diagrammatic, enlarged cross-section of Fig. 9 - with
25 one embossed web V2 having a relief design D2, while the web V1 is only embossed with a pattern of projections reproducing the projections 13P on the embossing roller 13 and has no relief design.

A further type of product is obtained by passing
30 one of the two webs, for example the web V2, only through the lamination zone between the two embossing rollers 13, 15, without previously passing it between an embossing roller and a pressure roller. This alternative route is shown in dashed lines in Fig. 5. In this case,
35 a strip material is produced - shown in enlarged local cross-section in Fig. 10 - in which the web V2 is embossed with a design reproducing the projections on the embossing roller 13 in negative form and the relief

design D1 in positive form, and is joined by means of gluing to a non-embossed web V1.

Figs 11 and 12 show a specific form of incision in the embossing roller 13. In this case the design, of which a portion can be seen in planar development in Fig. 11, is defined by pairs of essentially parallel incision lines 13C', 13C''. Some projections 13P remain between the two lines 13C' and 13C'', as can be seen quite clearly in the section of Fig. 12. A specific aesthetic effect can be produced in this way.

When the strip material consists of a plurality of webs which are joined together by means of gluing, it is possible to use a coloured glue so as to give an additional aesthetic effect. This is a technique known per se and is employed in embossing units of the point-to-point type having the structure illustrated Fig. 5. Nevertheless, the use of this technique in conjunction with an embossing roller having a recessed design produces novel, high quality results and an unexpected aesthetic effect on account of the fact that that area of the strip material which is in relief, corresponding to the recessed design on the roller, will not be coloured because the entire design area D does not receive any glue. The result is a two-tone product in which the background, defined by the embossing produced by the projections 13P, 15P, is coloured as a result of the application of pigmented glue, whereas the relief design is the same colour as the original material - for example white.

It should be understood that the drawing shows only one example, given solely by way of a practical demonstration of the invention, it being possible for the forms and arrangements of the latter to vary without thereby departing from the scope of the concept underlying the said invention. Any reference numerals appearing in the appended claims have the purpose of facilitating reading of the claims with reference to the description and the drawing, and do not limit the scope of the protection represented by the claims.

CLAIMS

1. Embossing roller (1, 13, 15) comprising a plurality of projections (5; 13P; 15P) distributed in a given
5 pattern over a surface of the said embossing roller, these projections having a base (5B) and a top (5E), characterized in that a recessed design is formed in the said surface and consists of one or more indentations or incisions (7; 13C, 15C) that extend from the tops of the
10 said projections (5; 13P, 15P) to the bases thereof.
2. Embossing roller according to Claim 1, characterized in that the said recessed design is defined by discontinuous indentations or incisions.
3. Embossing roller according to Claim 1 or 2,
15 characterized in that the said recessed design is defined by indentations or incisions which are not parallel to the pattern of the said projections.
4. Embossing roller according to one or more of the preceding claims, characterized in that the depth of the
20 said recessed design is greater than the height (H) of the projections.
5. Embossing roller according to one or more of the preceding claims, characterized in that the said projections (5; 13P, 15P) are frustopyramidal or frustoconical
25 in shape and are distributed in a uniform geometric pattern over at least a portion of the embossing surface of the said roller (1; 13, 15).
6. Embossing roller according to one or more of the preceding claims, characterized in that the density of
30 the said projections is between 5 and 100 projections per cm² and preferably between 30 and 60 projections per cm².
7. Embossing roller according to one or more of the preceding claims, characterized in that the said
35 recessed design consists of one or more essentially parallel double incision lines, between which some of the said projections remain.
8. Embossing roller according to one or more of the preceding claims, characterized in that the said

recessed design is produced by milling a roller which has previously been provided with the said projections.

9. Embossing unit comprising at least a first embossing roller (1; 13) and at least a first pressure roller (3; 15) operating in conjunction with the said embossing roller, characterized in that the said first embossing roller is a roller according to one or more of Claims 1 to 8.

10. Embossing unit according to Claim 9, characterized in that the said first pressure roller (3; 16) has a yielding surface into which the projections of the first embossing roller penetrate.

11. Embossing unit according to Claim 9 or 10, characterized in that it comprises a second embossing roller (15) operating in conjunction with a second pressure rollers (17), the said first and the said second embossing roller being positioned with their axes parallel and adjacent to each other so as to define a nip through which at least two webs (V1, V2) of a strip material (N) pass.

12. Embossing unit according to Claim 11, characterized in that both the said embossing rollers (13, 15) are made according to one or more of Claims 1 to 8.

13. Embossing unit according to Claim 11, characterized in that the said second embossing roller (15) has a plurality of projections (15P) distributed in a pattern that corresponds to that of the projections (13P) on the said first embossing roller (13), but where the said recessed design is absent.

14. Method of embossing a strip material (N), in which the said strip material is passed between an embossing roller (1; 13; 15) provided with a plurality of projections (7; 13P; 15P) in order to be subjected to a deformation produced as a result of the contact pressure between the said embossing roller and a pressure roller (3; 16; 17), characterized in that a relief design (D; D1; D2), produced by a corresponding recessed design (7; 13C; 15C) in the said embossing

roller, is superimposed on to the said strip material, over the deformation produced by the said projections.

15. Method according to Claim 14, characterized in that a plurality of webs, forming the said strip
5 material, are embossed simultaneously, by passing them between a single embossing roller (1) and a corresponding pressure roller (3).

16. Method according to Claim 14, characterized in that two webs (V1, V2) are embossed separately between
10 an embossing roller (13; 15) and a pressure roller (16; 17) respectively and in that the said webs are subsequently joined together in order to form the said strip material (N).

17. Method according to Claim 16, characterized in
15 that the said relief design (D1) is formed on only one of the said webs.

18. Method according to Claim 17, characterized in that the said relief design (D1, D2) is formed on both the said webs.

20 19. Method according to Claim 14, characterized in that a first web (V1) is embossed and in that the said first embossed web is joined to a second, non-embossed, web (V2).

20. Method according to one or more of Claims 14 to
25 19, characterized in that at least two webs (V1, V2) are joined together by applying a coloured glue, the said glue being applied in the region of the said projections (15P).

21. Embossed strip material, characterized in that,
30 on at least one of its surfaces, a relief design is superimposed over the embossing.

22. Strip material according to Claim 21, characterized in that the said relief design is discontinuous.

23. Strip material according to Claim 21 or 22,
35 characterized in that the said relief design is not parallel to the embossing.

24. Strip material according to one or more of Claims 21 to 23, characterized in that it comprises at

least two joined webs which are embossed simultaneously by passing them between the same pair of rollers.

25. Strip material according to one or more of Claims 21 to 23, characterized in that it comprises at least two joined webs (V1, V2) which are embossed separately before being joined together.

26. Strip material according to Claim 25, characterized in that only one of the said webs has the said relief design which is superimposed over the said embossing.

27. Strip material according to Claim 25, characterized in that both the said webs have the said relief design which is superimposed over the said embossing.

28. Strip material according to one or more of Claims 21 to 23, characterized in that it comprises at least two joined webs (V1, V2), at least one (V1) of which has the said embossing and the said relief design, while at least one of them is smooth.

29. Strip material according to one or more of Claims 21 to 28, characterized in that it comprises at least two webs which are joined together by means of a coloured glue, the said relief design not being coloured.

30. Strip material according to one or more of Claims 21 to 28, characterized in that the height of the said relief design is greater than the depth of the said embossing.

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FIG. 1

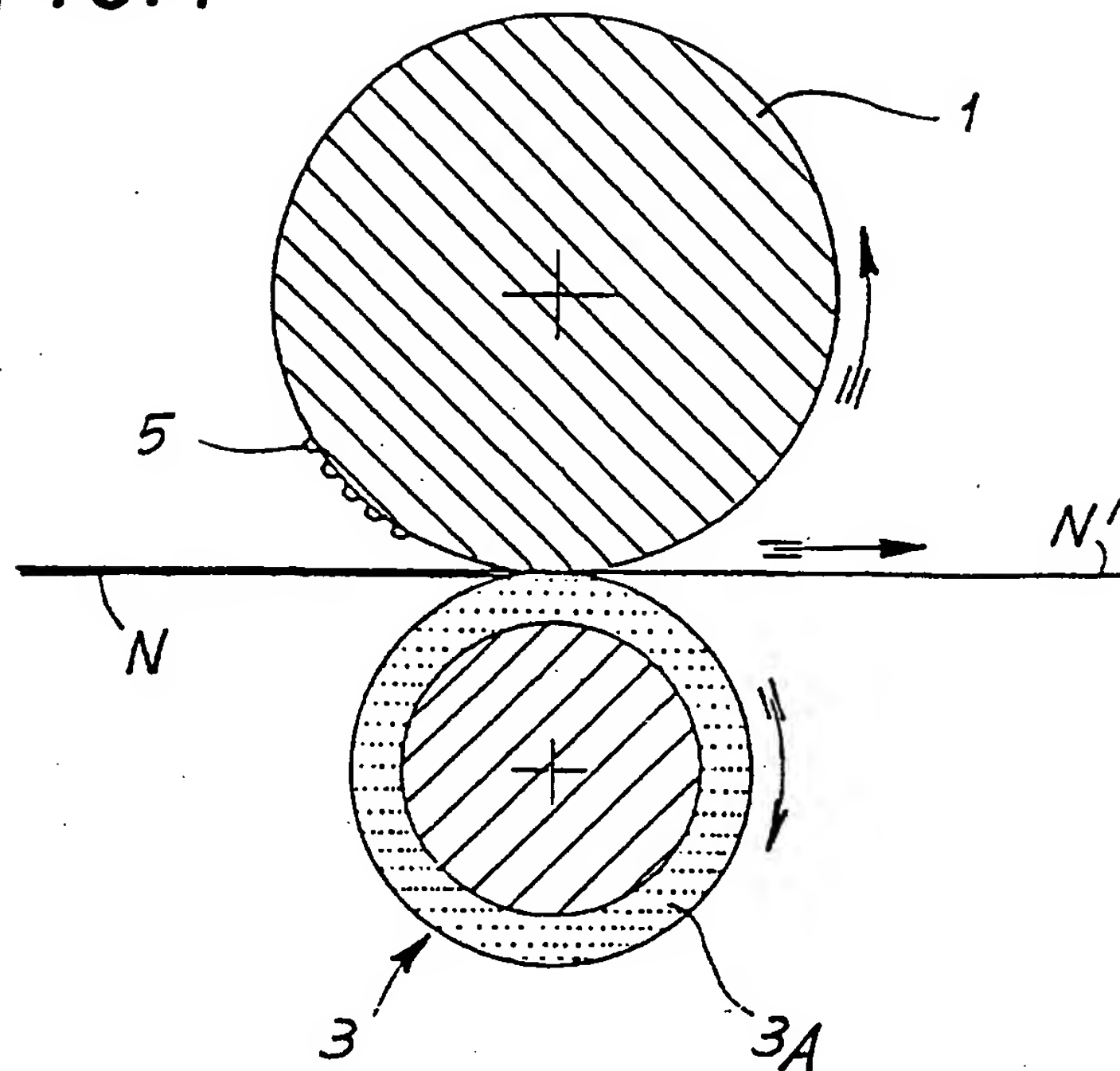
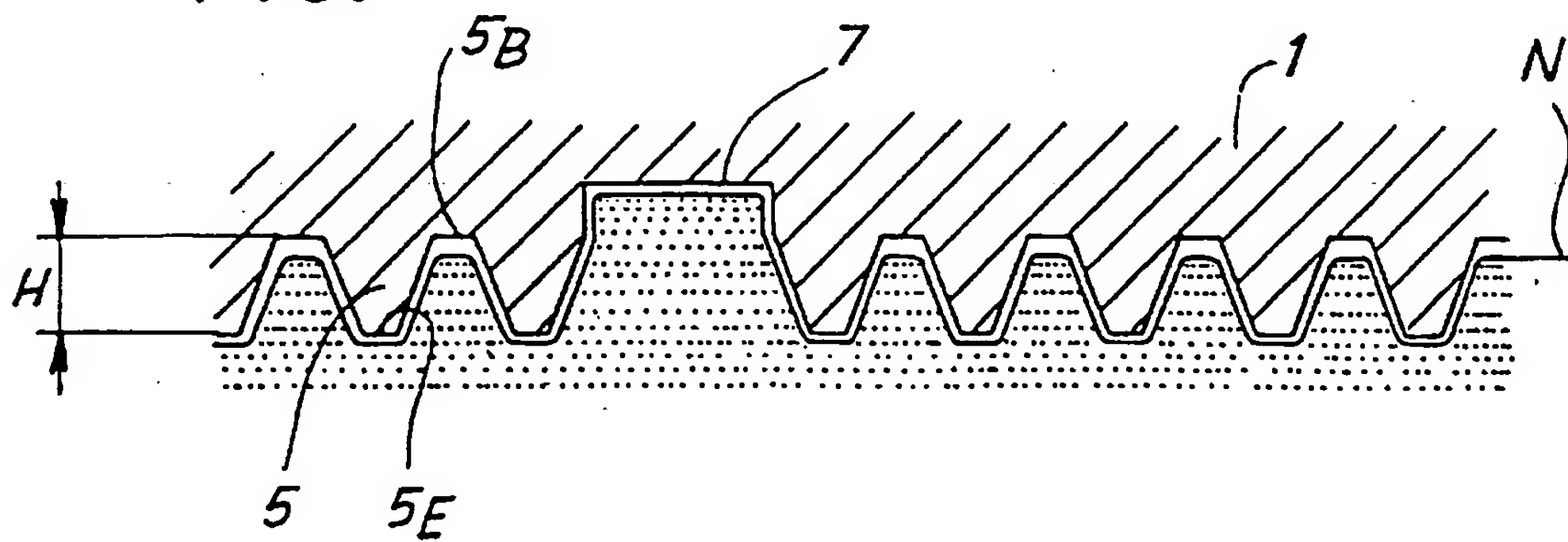


FIG. 2



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FIG. 3

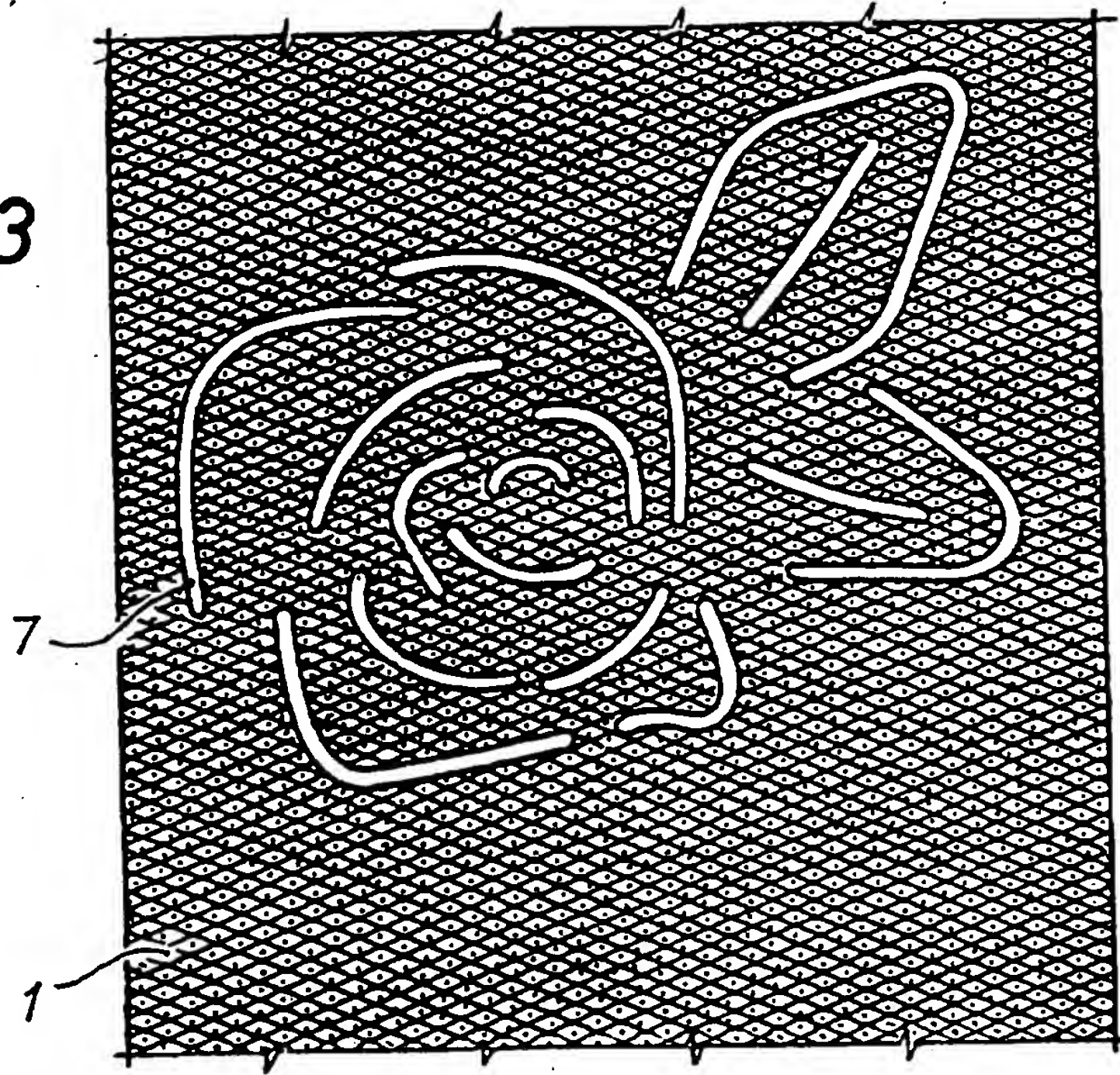
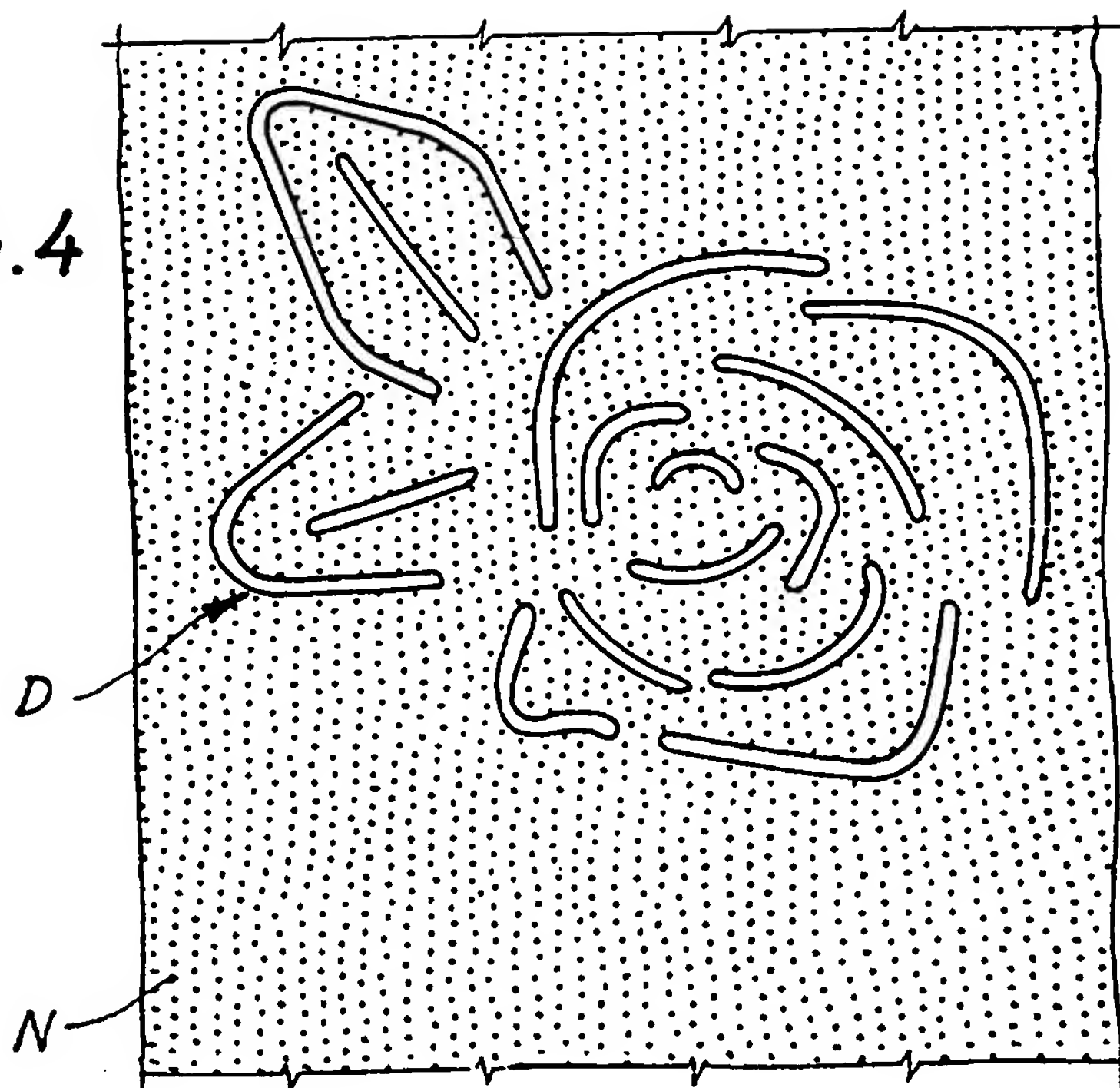


FIG. 4



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FIG. 5

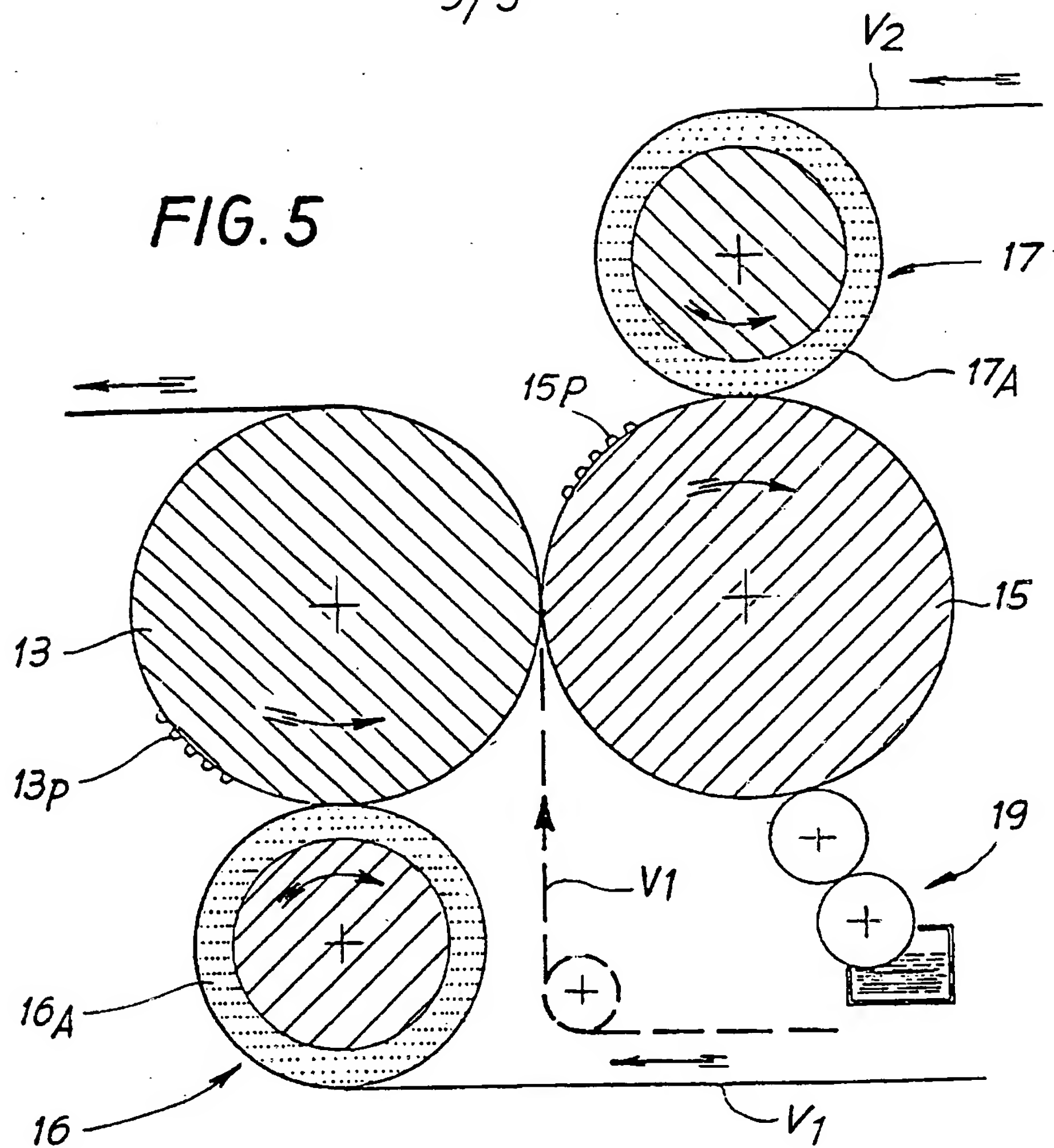
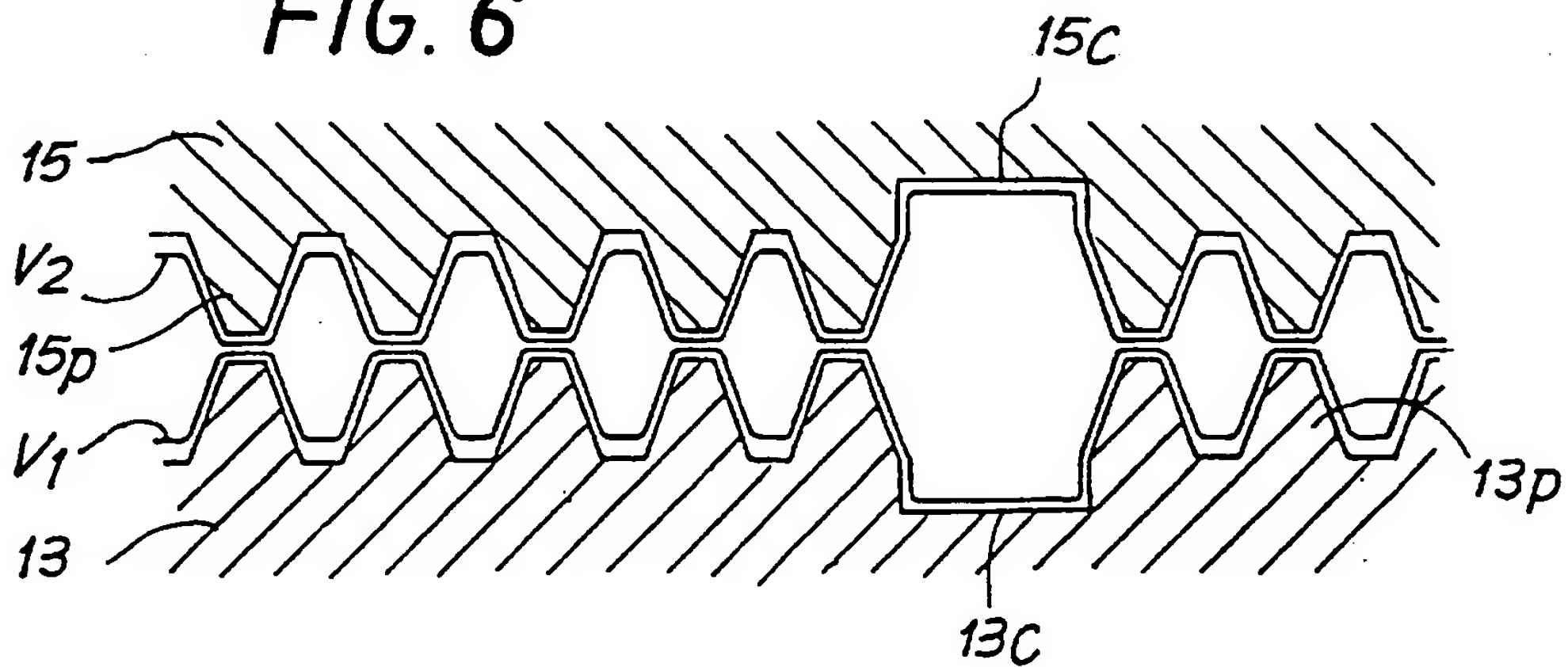
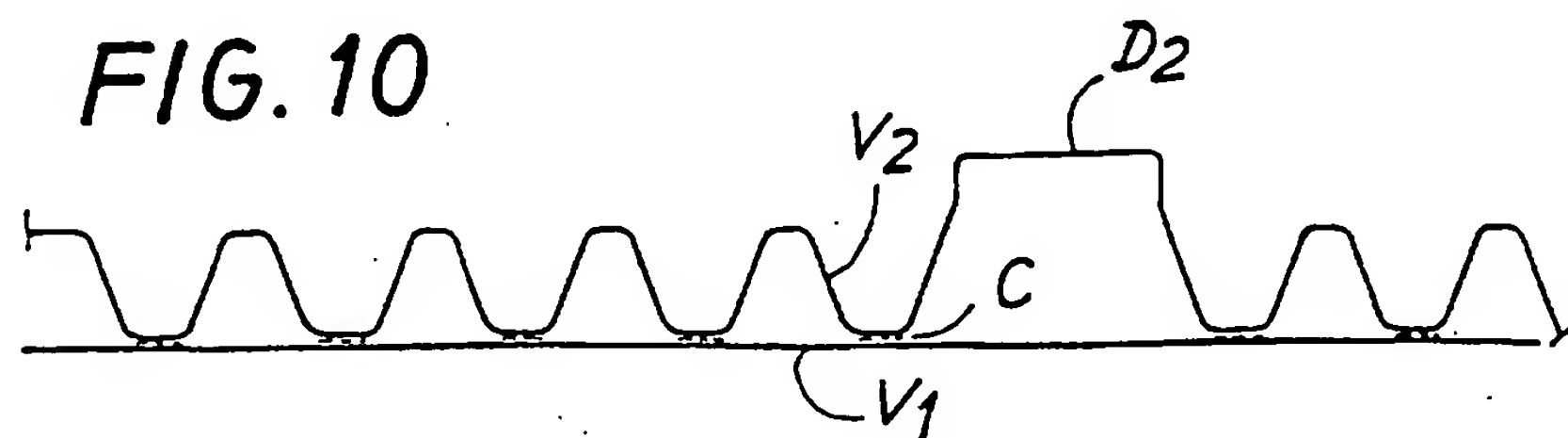
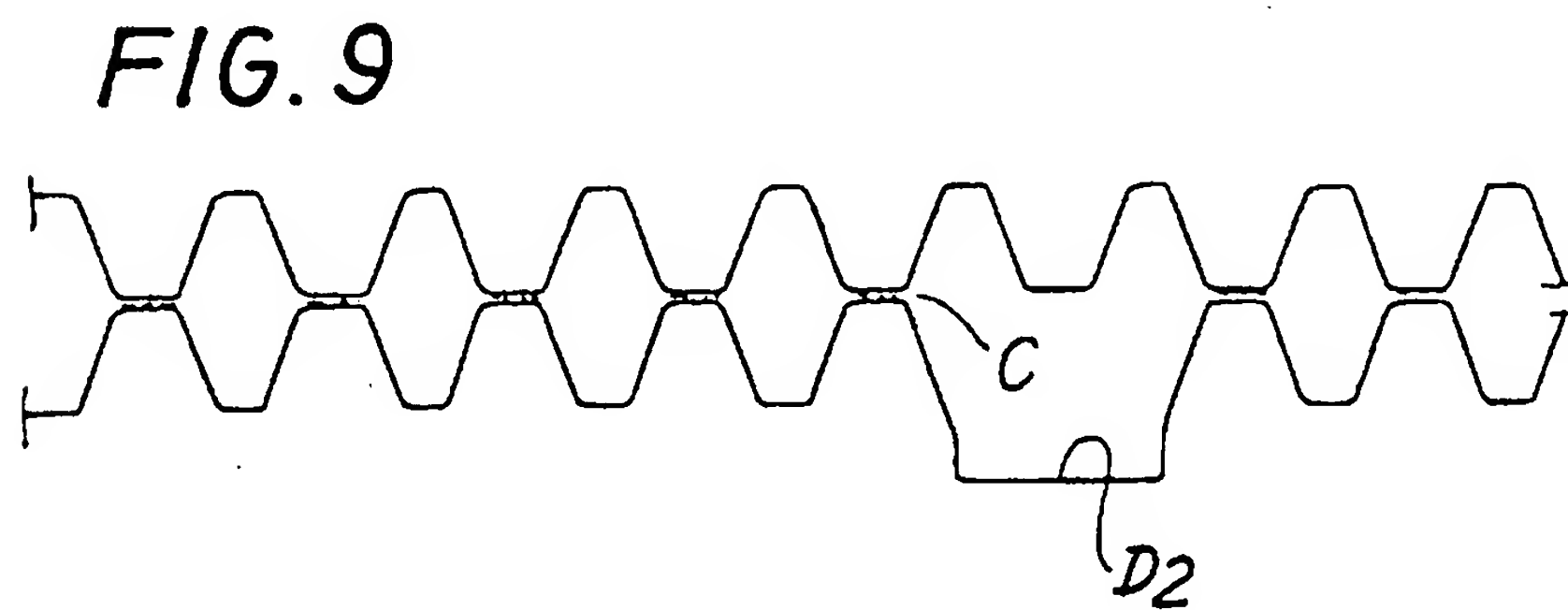
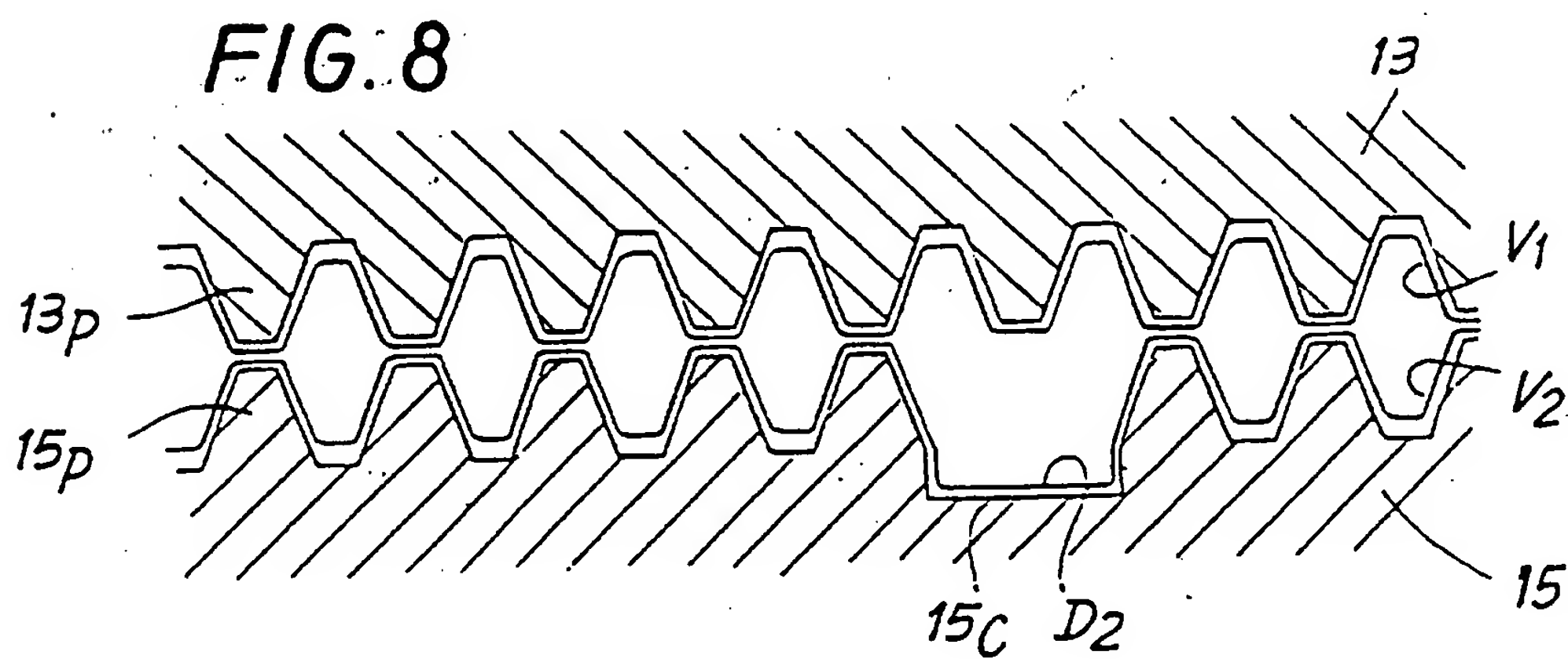
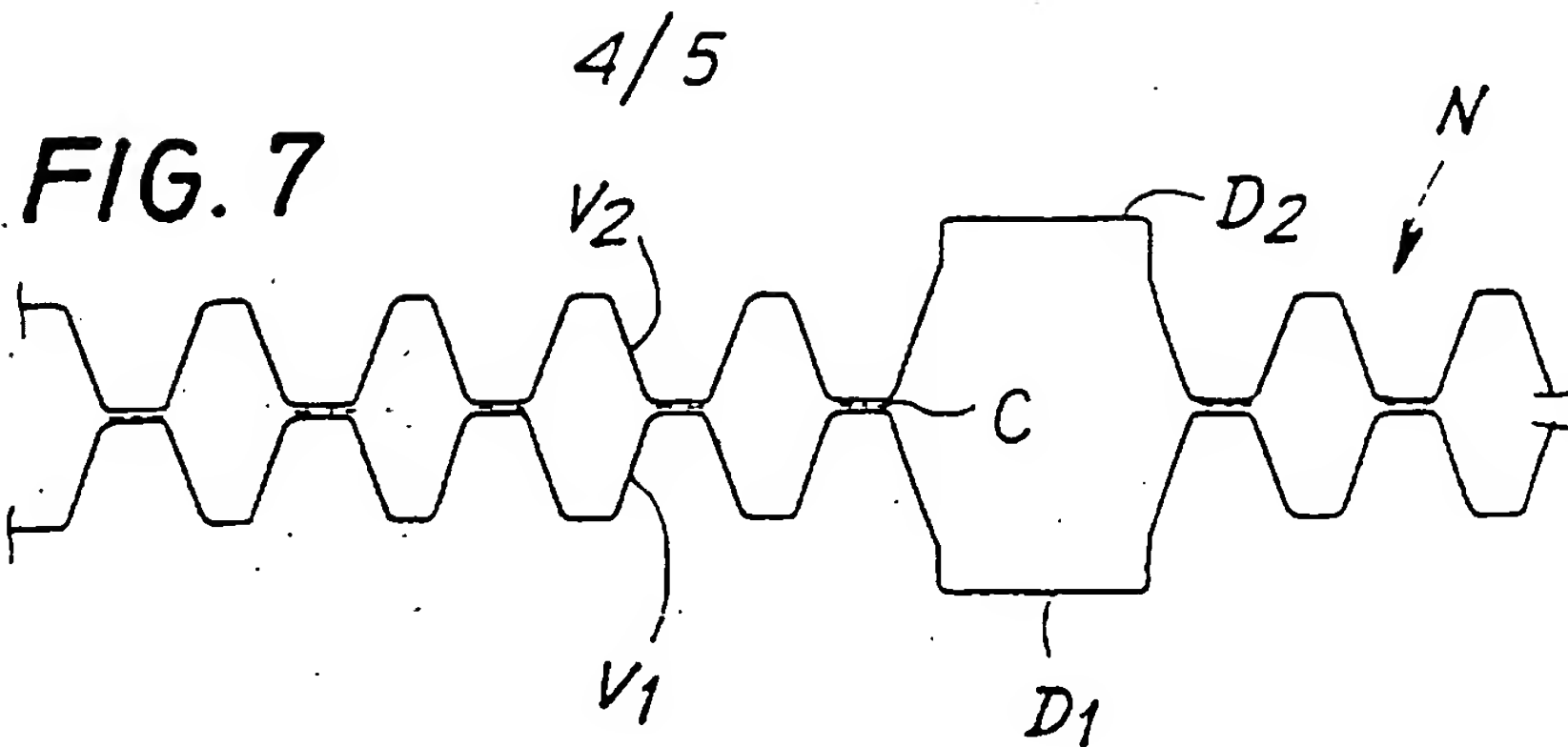


FIG. 6





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FIG. 11

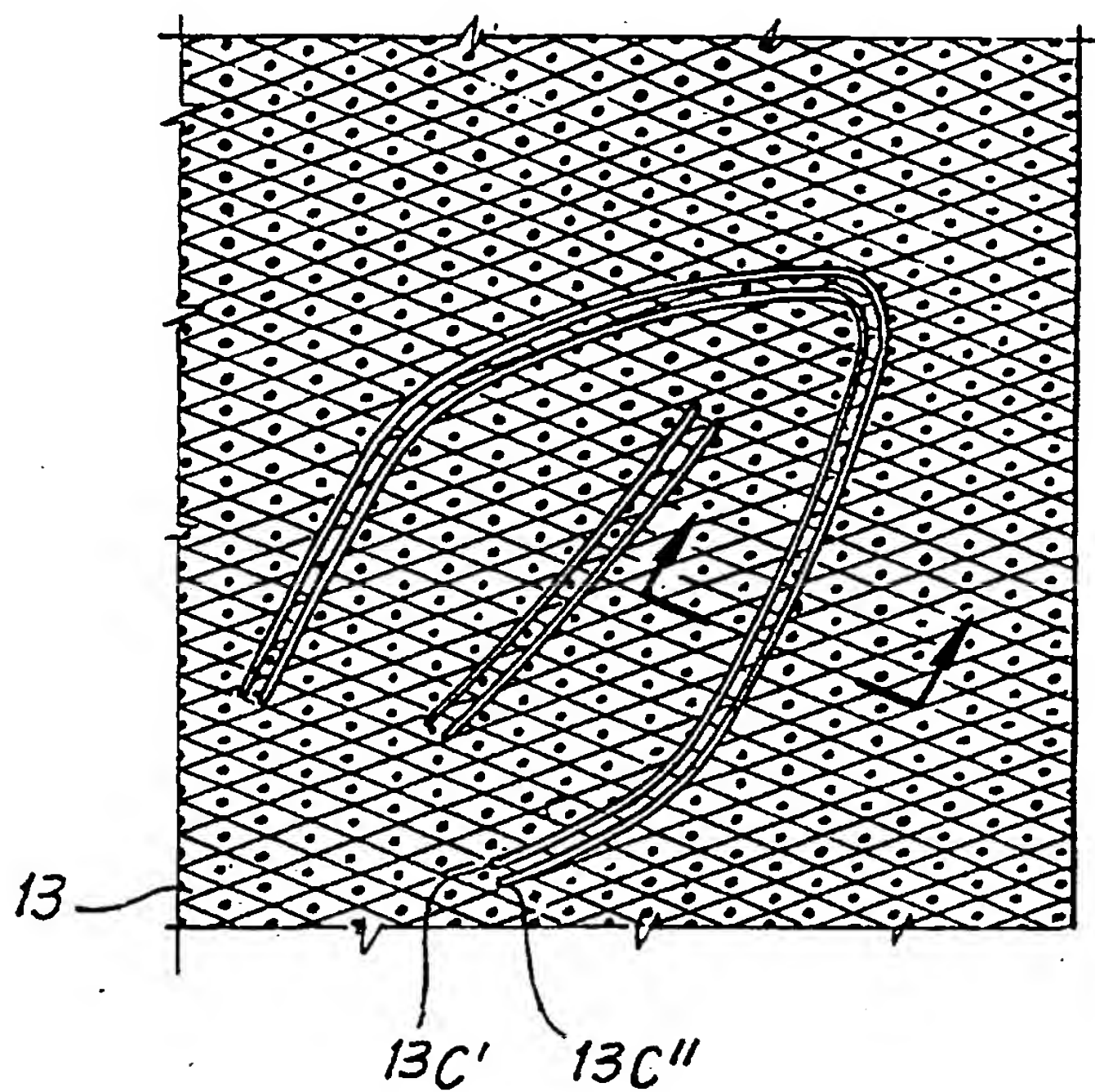
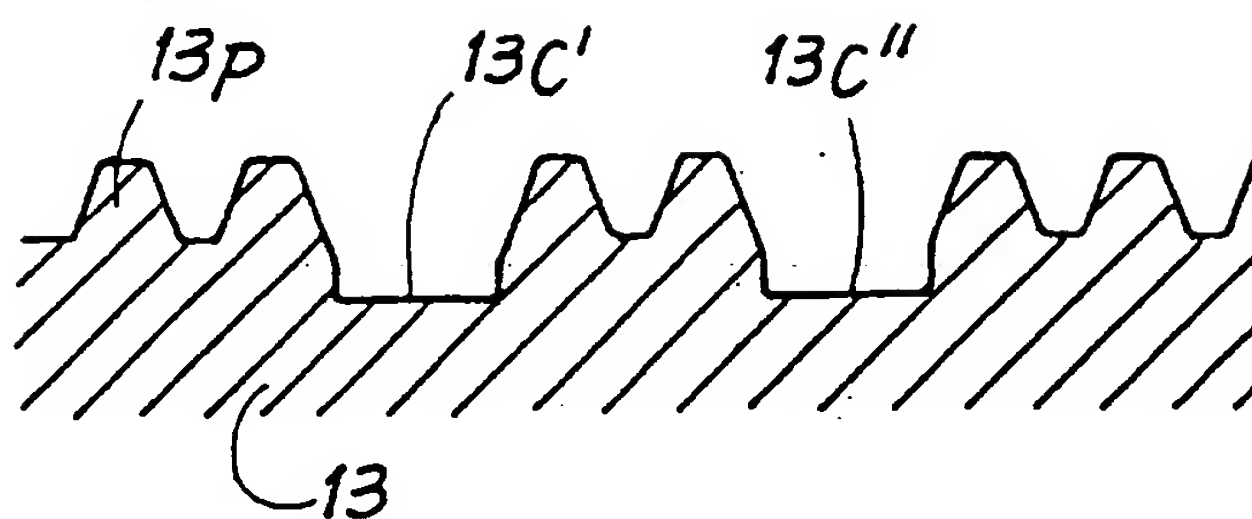


FIG. 12



INTERNATIONAL SEARCH REPORT

Inv. nal Application No
PCT/IT 97/00136

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B31F1/07 D21H27/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B31F B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	WO 96 18771 A (KAYSERSBERG SA ; LAURENT PIERRE (FR); LEFEBVRE DU GROSRIEZ CAROL (F) 20 June 1996 see figures	21-23, 25,28 1-7, 9-11, 14-16
X A	US 4 320 162 A (SCHULZ GALYN A) 16 March 1982 cited in the application see figures	21-23, 25,28 1-7, 9-11, 14-16
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☒ Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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